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**Notes:**

1. Untranslatable words are replaced with asterisks (\*\*\*\*).
2. Texts in the figures are not translated and shown as if is.

Translated: 23:21:02 JST 04/20/2009

Dictionary: Last updated 04/14/2009 / Priority.

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**CLAIM + DETAILED DESCRIPTION**

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**[Claim(s)]**

[Claim 1] In a device which measures a filling pressure and resin temperature at the time of filling up an injection mold with resin, A heater for prevention from solidification of resin which counters a spool entrance of a metallic mold in a nozzle tip of an injection machine, arranges a measuring jig provided with a resin passage to the above-mentioned metallic mold so that between both may be connected, and is introduced into the above-mentioned spool via the above-mentioned resin passage, The pressure/temperature measurement device of an injection mold providing a pressure sensor and/, or a temperature sensor which measures pressure of resin and/which pass the above-mentioned nozzle, or temperature in the above-mentioned measuring jig.

[Claim 2] The pressure/temperature measurement device of the injection mold according to claim 1 making a peripheral wall of the above-mentioned resin passage have faced a detection part of the above-mentioned pressure sensor and/, or a temperature sensor.

[Claim 3] Claim 1 which a thermo couple is used for the above-mentioned temperature sensor, and is further characterized by equipping a thermo couple for temperature control of the above-mentioned heater, or the pressure/temperature measurement device of an injection mold given in 2.

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**[Detailed Description of the Invention]****[0001]**

[The technical field to which an invention belongs] Especially this invention relates to the pressure/temperature measurement device of the injection mold used for collection of the data for verification of the \*\*\*\*\* pressure analysis program in an injection-molding CAE (Computer Aided Engineering) system, etc. about the pressure/temperature measurement device of an injection mold.

**[0002]**

[Description of the Prior Art] [the Measurement Division for verifying pressure/temperature, such as a \*\*\*\*\* pressure analysis program of an injection-molding CAE system, conventionally ] The form of installing a pressure sensor and a temperature sensor in form, the spool of a metallic mold, a runner, a gate section that install a pressure sensor and a temperature sensor in the cylinder nozzle of an injection molding machine is known.

[0003]

[Problem to be solved by the invention]However, [ in the form of the former which installs a pressure sensor and a temperature sensor in the cylinder nozzle of an injection molding machine ] On the structure of a cylinder nozzle, since very big pressure loss (Juncture loss) occurs by reduction flow in the nozzle tip part, the exact data for verification is unextractable. That is, the present condition is that the state of actual pressure/temperature in the time of melting resin passing through a nozzle tip is not known even if it measures the pressure/temperature in the cylinder nozzle of an injection molding machine.

[0004]A portion of an above-mentioned SHINRINDA nozzle is heating with a heater, have become high temperature, and, [ and a resin flow part ] Since it is high pressure, heat resistance/resistance to pressure is needed for composition of a pressure sensor or a temperature sensor, in connection with this, exact Measurement Division becomes difficult, leak of melting resin arises depending on the case, and a problem arises also in endurance as a measuring device.

[0005][ in the form of the latter which installs a pressure sensor and a temperature sensor in a spool of a metallic mold, a runner, a gate section, etc. ] Since in addition to a problem of the above-mentioned pressure loss a remarkable temperature change will occur in resin by the time it reaches a sensor position from a cylinder nozzle tip part, comparison verification between data and a CAE system which were measured is difficult. That is, since the position in which a sensor was installed can evaluate only pressure by the side of the lower stream, it has the fault that pressure loss of the whole metallic mold cannot measure correctly. In a DEPA part of a spool, a concrete problem of being hard to install an above-mentioned sensor is also unavoidable.

[0006]This invention was made based on the above-mentioned situation, and A spool, a runner, It is advantageous to measurement of filling pressure power of the whole metallic mold including a cavity, and temperature at the tip of a spool is also measurable, Can use for collection of data for verification of a \*\*\*\*\* pressure analysis program of an injection-molding CAE system, etc., and further, It is going to provide the pressure/temperature measurement device of an injection mold which can be used also as pressure of injection-molding feedback control currently performed in order to obtain a cast which was excellent in quality, and a sensing device of temperature.

[0007]

[Means for solving problem]For this reason, in the device which measures the filling pressure and resin temperature at the time of filling up resin with this invention into an injection mold, The heater for the prevention from solidification of the resin which counters the spool entrance of a metallic mold in the nozzle tip of an injection machine, arranges the measuring jig provided with the resin passage to the above-mentioned metallic mold so that between both may be connected, and is introduced into the above-mentioned spool via the above-mentioned resin passage, The pressure sensor and/, or the temperature sensor which measures the pressure of resin and/which pass the above-mentioned nozzle, or temperature was provided in the above-mentioned measuring jig.

[0008]Therefore, since the grade by which a sensor is put to high pressure/high temperature decreases, it compares with the conventional method installed in the cylinder nozzle of an injection molding machine, Since it is not necessary to become very advantageous in respect of the simplicity of measurement, or endurance, and to estimate the influence of the pressure loss within a cylinder nozzle, it is possible to measure correctly the pressure of the resin with which it is filled up in a forming metallic mold. And also in

measurement of temperature, since the measuring jig itself is heated with the heater, and the temperature of a temperature sensor is brought close to the temperature of the resin to measure and can be set, in the state where it is not affected by the influence of a fall of the response sensitivity by the calorific capacity at the time of measurement of a sensor, it is measurable.

[0009]In order to perform measurement by this invention between the tip part of a metallic mold spool, and the cylinder nozzle of an injection molding machine, Since the filling pressure power of the whole metallic mold in consideration of the pressure loss of the spool tip part can be measured compared with the conventional method which installs a pressure sensor and a temperature sensor in the spool and runner in a metallic mold, and a gate section, comparison verification of a CAE system becomes easy.

[0010]The measuring device of this invention can be used also as the so-called pressure of the injection-molding feedback control currently performed in order to obtain the cast which was excellent in quality, and a sensing device of temperature.

[0011]

[Mode for carrying out the invention]Hereafter, an embodiment of the invention is concretely described with reference to Drawings. The measuring device shown in drawing 1 counters the entrance of the spool 2A (formed in the sprue bush 2) of the metallic mold A in the nozzle tip of an injection machine (not shown), The heater 5 for the prevention from solidification of the resin which arranges the measuring jig 1 provided with the resin passage 6 to the metallic mold A so that between both may be connected, and is introduced into the spool 2A via the resin passage 6, The pressure sensor 7 and the temperature sensor 9 which measure the pressure and temperature of resin which pass the above-mentioned nozzle are provided in the measuring jig 1.

[0012]Especially the measuring jig 1 is equipped in the positioning ring 3, and makes the peripheral wall of the resin passage 6 have faced the detection part (pressure transfer pin) of the pressure sensor 7, and the detection part of the temperature sensor 9 in this embodiment. If it requires, a thermo couple is used for the temperature sensor 9, and the thermo couple 10 for heaters for temperature control of the heater 5 is equipped further. The measuring jig 1 forms in the entrance of the resin passage 6 the surface-of-a-sphere-like nozzle touch part 4 which receives the nozzle tip of an injection machine.

[0013]The path of the entrance of the spool 2A is set up more greatly than the path of the resin passage 6, and if it is undercut \*\* at the time of mold release of a cast, it is devised so that there may be nothing.

[0014]Since it is such composition, temperature adjustment of measuring jig 1 the very thing can be carried out with the heater 5, and cooling solidification of resin in a measurement part can be prevented, and measurement of pressure and temperature can carry out correctly at the resin passage 6. In this embodiment, although both equipped the measuring jig 1 with the pressure sensor 7 and the temperature sensor 9, only that either may be equipped and measurement of a CAE system may be presented.

[0015]

[Working example]Next, the example at the time of applying the measuring device of this invention to an injection-molding CAE system is explained. Here, the measuring jig 1 forms in the entrance side of the resin passage 6 the nozzle touch part 4 of the shape of a surface of a sphere which the cylinder nozzle tip of an injection molding machine touches, and melting resin is ejected from here in a metallic mold. The heater 5 is attached to the measuring jig 1.

By work of the thermo couple 10 for heaters, it is used in order to control the temperature of the measuring

jig 1 to constant temperature.

Here, the resin passage 6 is carrying out an one side = 3.5 mm square section, and the channel length is 20 mm.

[0016]this resin passage 6 -- the pressure transfer pin 8 as a tip detection part of the pressure sensor 7 has attended the central peripheral wall mostly.

It counters with this, and it has equipped so that the detection part of the temperature sensor 9 may project a tip slightly.

To the pressure sensor 7, it is possible to use again the direct pressure-type sensor which does not pass the pressure transfer pin 8 for a temperature sensor for an infrared temperature sensor besides a thermo couple etc. And the detected pressure/temperature data are processed with a data processing device (not shown) with the measurement data in other metallic molds.

[0017]Next, the actual example of measurement is explained in this example. As shown in drawing 2, the cast which performed actual measurement in this example is disc-like [ diameter:90mm and board thickness:2mm ].

In the metallic mold A which fabricates this, the pressure sensor was attached to the disk-shaped central part (the disk-part center of drawing 2: \*\* shows), and, simultaneously with the pressure/temperature survey by the side of the measuring jig 1, the pressure of the central part of the disk (cast) was measured.

[0018]The resin used for this fabrication is PMMA, and that process condition is resin temperature:250 \*\*, tool temperature:90 \*\*, injection speed:20mm/sec, and \*\* pressure value:80MPa (that \*\* pressure time: 20 sec). Each of these values is operation values. In this measurement, the temperature of the measuring jig 1 was controlled with the heater 5 equipped there to become 200 \*\* (fixed).

[0019]Drawing 3 is the shape of the above-mentioned cast, and a graph of the pressure / temperature survey result measured under the process condition. In this graph, injection time is taken along a horizontal axis and pressure and temperature are taken along a vertical axis. The pressure measured with this measuring device and temperature are the pressure and temperature which were measured with the pressure sensor 7 and the temperature sensor 9 of the measuring jig 1. The pressure of the central part of the cast is the measurement pressure in measurement position \*\* of drawing 2.

[0020]As shown in this graph, [ the pressure measured by the measuring jig 1 ] The \*\* pressure value which is a pressure value in the cylinder nozzle of an injection molding machine: Since there is pressure loss in the tip of a nozzle compared with 80MPa, in the actual spool tip part of a metallic mold, it turns out clearly that it is in the tendency (it is 17% of loss in this example) which pressure estimates low.

[0021]Therefore, in the case of comparison verification of a CAE system, the setting conditions in consideration of the pressure loss in this tip of a nozzle should be given, and the pressure/temperature in this tip of a nozzle can evaluate by Measurement Division by this measuring device quantitatively.

[0022]

[Effect of the Invention]This invention is equipping a metallic mold with the measuring jig which has a heater, and a pressure sensor and/or a temperature sensor, as explained in full detail above, When detecting the pressure/temperature at the time of resin restoration, there are few grades put to high pressure/high temperature, and a sensor's are very advantageous in respect of the simplicity of measurement, or endurance compared with the conventional method installed in the cylinder nozzle of an

injection molding machine.

[0023] Since it becomes unnecessary to estimate the influence of the pressure loss within a cylinder nozzle compared with the conventional method which installs a pressure sensor and a temperature sensor in the cylinder nozzle of an injection molding machine, it is possible to measure correctly the pressure of the resin with which it is filled up in a metallic mold. And also in measurement of temperature, since a temperature sensor's own temperature is brought close to the temperature of the resin to measure since the measuring jig is heated with the heater, and it can set, the influence of a fall of the response sensitivity by the calorific capacity at the time of a sensor's own measurement can also be stopped to the minimum, and exact measurement is possible for it.

[0024] Since measurement by this invention is performed between the entrance of a metallic mold spool, and the cylinder nozzle of an injection molding machine, compared with the method of installing a pressure sensor and a temperature sensor in a spool and runner of a metallic mold, and a gate section, the filling pressure power of the whole metallic mold in consideration of the pressure loss of the spool tip part can be measured. Therefore, comparison verification by a CAE system becomes quite easy. In this measuring device, it can use also as the pressure of the injection-molding feedback control currently performed in order to obtain the cast which was excellent in quality, and a sensing device of temperature.

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[Translation done.]